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Papers

Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm): A Scoping Review on Institutionalization, Effectiveness, and Dismantling

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Abstract
The primary sources of greenhouse gas (GHG) emissions in Brazil stem from activities associated with land use and forest changes, particularly due to the clearing of native vegetation. The agricultural sector is the second largest emitter. Geographically, the Amazon region is the focal point of these emissions, and the escalating deforestation in the area led to the creation of the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm, in Portuguese) in 2004. This article presents the results of a literature mapping focused on the PPCDAm, guided by key questions regarding the institutionalization process of the plan, its effectiveness, and its recent period of dismantling, as analyzed from the perspective of specialized literature. The methodology adheres to the Joanna Briggs Institute (JBI) standards for Scoping Reviews (ScR). This review enabled the description and analysis of the four phases of the PPCDAm, spanning from 2004 to 2019, highlighting the effectiveness of the plan's initial phases (2004–2012), which achieved an 84% reduction in deforestation by 2012 compared to 2004. The literature mapping revealed a gap in academic studies concerning the analysis of the fourth phase (2016–2019) and the dismantling of the plan. This phase is contextualized by Brazil's focus on mitigating climate change to meet the targets of the National Climate Change Plan for 2020, the signing of the Paris Agreement—committing to zero illegal deforestation by 2030—, and the political shifts during the Temer administration and the beginning of the Bolsonaro administration, at which point the PPCDAm was discontinued.

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INTRODUCTION

Climate change can be understood as long-term transformations in temperature and climate patterns that, over Earth's geological history, were caused by natural processes but have, since the First Industrial Revolution, been increasingly influenced by anthropogenic activities. Primarily due to the burning of fossil fuels for energy used in industrial development, transportation, and the dissemination of lifestyles and consumption patterns originating from the model established in the United Kingdom in the 18th century, human activities have become major drivers of climate change. The release of gases such as carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons, and others—emitted through industrial, transportation, and agricultural processes—intensifies the greenhouse effect, consequently exacerbating climate transformations on a global scale.

However, as highlighted by the Greenhouse Gas Emission and Removal Estimating System (SEEG, 2023), Brazil presents a somewhat distinct case. Between 1990 and 2022, the primary sources of greenhouse gas (GHG) emissions were linked to land use and the forestry sector, which was strongly associated with deforestation of native vegetation, followed by the agricultural sector.

In addition, according to Carbon Brief, which analyzes national responsibility for historical CO_2 emissions from 1850 to 2021, Brazil ranks fourth globally, primarily due to emissions from the land use and forestry sector (Evans, 2021). In 2022, the land use change sector was responsible for emitting 1.12 billion tons of CO_2 equivalent, accounting for 48% of the national total. Of this 1.12 billion tons, 97% were attributed to deforestation. Furthermore, of the total emissions from deforestation, 75%—equivalent to 837 million tons of CO_2—originated in the Amazon (SEEG, 2023).

Since the late 1990s and early 2000s, deforestation rates in the Legal Amazon have risen significantly, with deforestation reaching 18,200 km² in 2000 and 2001, and 21,600 km² in 2002 (Terra Brasilis, 2023). In response, the Plano de Ação para Prevenção e Controle da Amazônia Legal (PPCDAm, the subject of this paper, which is the governmental Action Plan developed and implemented for prevention and control of deforestation in the Legal Amazon) was launched in 2004 to curb deforestation in the region. The plan was deemed effective in reducing deforestation rates between 2004 and 2012 (Silva Junior *et al.*, 2021), after which it faced a series of setbacks. Well-established experts in the field argue that designing future measures to control and prevent deforestation in the Legal Amazon requires understanding the role of the PPCDAm, both in its initial success in reducing deforestation and in the subsequent rise in deforestation rates (West; Fearnside, 2021).

This study aims to map the literature addressing the understanding of the PPCDAm and its implications for deforestation in the Legal Amazon. A total of 30 documents, including articles, theses, dissertations, and policy documents, were analyzed. These were retrieved from the Scopus database, the Biblioteca Digital Brasileira de Teses e Dissertações (BDTD, which is a federal digital database for Theses and Dissertations approved within Brazilian Master´s and Doctoral programs), and Policy Commons between September and November 2023. Given the essentially exploratory nature of this review, it does not aim to encompass all existing knowledge in the field under analysis.

The methodology employed adheres to the standards of the Joanna Briggs Institute (JBI), applying the extension of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) for Scoping Reviews (ScR) (Peters *et al.*, 2020; Peters *et al.*, 2022). The study is organized into four sections, including this introduction. The second section outlines the methodology used in the research that underpins this article, detailing the main stages of the scoping review. The third section presents the results from the searches conducted in the selected databases, as well as the findings summarized in the PRISMA flowchart. The fourth section consists of a discussion framed by the questions formulated within this scoping review. The fifth and final section is dedicated to the conclusions.

METHODOLOGY

This study employed the Scoping Review (ScR) approach, which can be broadly understood as a method for defining the boundaries of a field to map problems, key concepts, and other elements that constitute a research area, including its questions, main sources, and types of available evidence (Arksey; O'Malley, 2005). It is a literature mapping methodology that enables the transparent, reproducible, and effective synthesis of evidence based on specific research

questions and the use of databases appropriate to the field of study (Khalil *et al.*, 2024).

The structure of the review comprises steps conducted rigorously and transparently, following the strategies outlined by Aromataris *et al.* (2024), with the entire process meticulously documented.

The first step consists of formulating the research question, which in the case of the present study is stated as follows: "How has the literature observed the institutionalization, effectiveness, and dismantling of the Action Plan for the Prevention and Control of Deforestation in the Legal Amazon (PPCDAm)?" It is important to note that, in the context of this work, the term "effectiveness" should be understood as defined in the respective entry of the Aulete Digital dictionary, which is "the quality of being effective, the ability to produce the desired or expected outcome." The expected outcome of the PPCDAm is the reduction of deforestation; its effectiveness refers to the capacity to produce this outcome.

The second step involves identifying relevant studies. To this end, the PCC Strategy (problem, concept, and context) was formulated to define the search terms based on keywords. Identification was guided by the ScR criteria outlined in the JBI manual (Peters *et al.*, 2020), using author keywords and other keywords developed through an interaction step with the databases. The PCC strategy, according to the guidance of Peters *et al.* (2020) and Aromataris *et al.* (2024), enables the construction of search strategies by combining query strings through the alignment of keywords according to their relevance to each element of the PCC acronym: P – for Problem and/or Policy and/or Population; C – for Concept; and C – for Context, as detailed in Table 1 below. The strategy was applied across four document databases: Scopus, BDTD, Policy Commons, and SciELO. The Scopus database (which includes white literature such as books, chapters, and articles) was chosen for its extensive coverage of literature in the field of Applied Social Sciences. To encompass grey literature (which includes dissertations, theses, and conference papers), the BDTD, was included, managed by the Instituto Brasileiro de Informação em Ciência e Tecnologia (IBICT, a Brazilian Institute which is a unit of the Ministério de Ciência e Tecnologia (MCTI - Ministry of Science, Technology, and Innovation). The Policy Commons database was included to capture policy documents (Población; Noronha, 2002). No results were obtained from the SciELO database.

Chart 1 - PCC Strategy

Strategy	**Querry Strings**
P- Problem / Policies / Population	“deforestation” OR “forest degradation” OR “forest destruction” OR “biodiversity” OR “climate change*” OR “savannization” OR “clear-cutting*” OR “drought” OR “extreme weather" OR "extreme climate event*" OR "tipping point”
AND	
C- Concept	"The Action Plan for the Prevention and Control of Deforestation in the Legal Amazon" OR "Action Plan for Prevention and Control of Deforestation in the Amazon" OR "Plan of Action for the Prevention and Control of Deforestation in the Amazon" OR “PPCDAM”
AND	
C- Context	“Amazon*” OR “Brazil*”

Source: The authors (2024).

The third step involves the selection and screening of studies, with the results presented through the PRISMA flowchart (see Figure 1). In accordance with Peters *et al.* (2020) and Aromataris *et al.* (2024), the PRISMA flowchart, which represents the documents selected at each step of the scoping review methodology guided by JBI standards, is the preferred way to identify these results, i.e., the documents retrieved, screened, and selected, along with the numbers of exclusions and inclusions throughout the successive stages of the ScR. Thus, the JBI recommends that the PRISMA flowchart be presented in the "results" section of a scoping review, not in the methodology section, as clarified by the same authors. Additionally, in

line with JBI's recommendations for ScR, no temporal or language limitations were applied (Peters *et al.*, 2020). However, for the analysis of policy documents from the Policy Commons database, the inclusion criterion was limited to documents in Portuguese, to better understand the processes and contexts in which the information is embedded, as the PPCDAm is a national policy in Brazil.

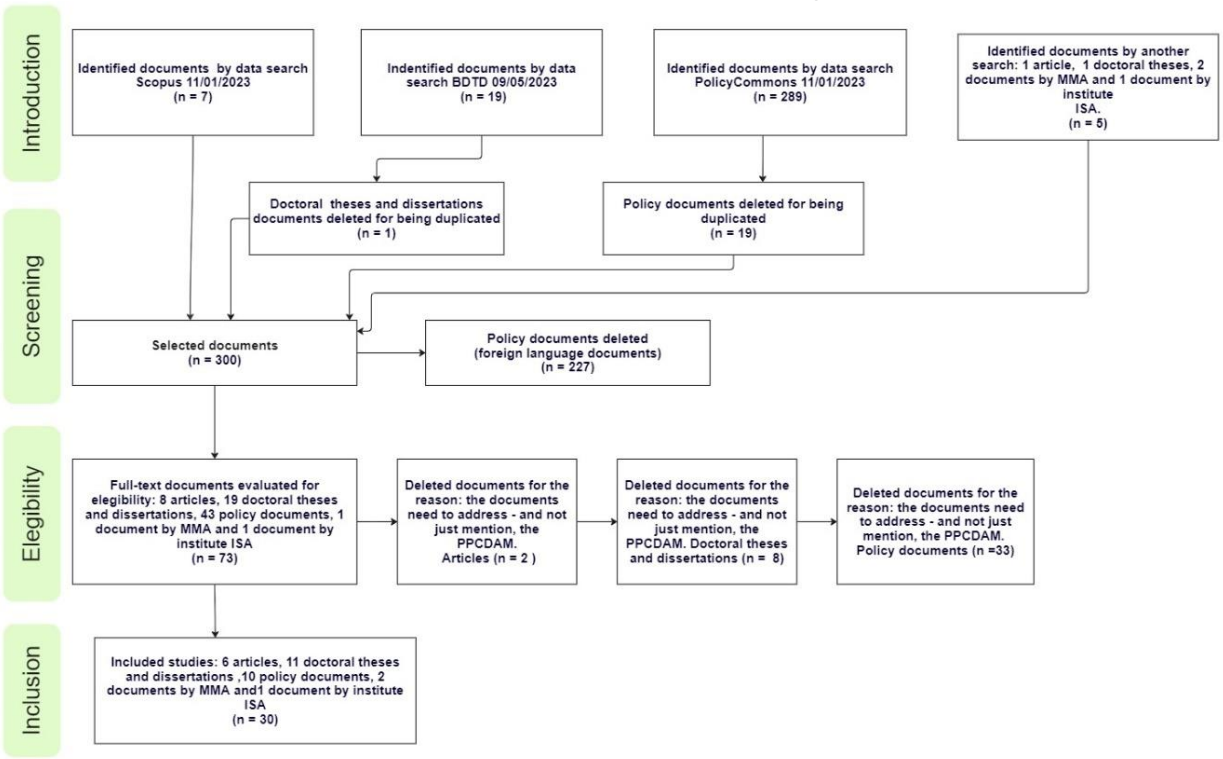
The eligibility criteria employed for the inclusion and exclusion of documents were: a) the documents must address at least one phase of the Plan (including its institutionalization and the other phases of the PPCDAm); and b) the documents should not be limited to merely mentioning the PPCDAm.

The fourth step involves the coding and analysis of the documents included in the review. For coding, a data extraction tool was developed, following JBI's recommendations, in the form of an Excel spreadsheet that distinguishes between documents from the Scopus, BDTD, and Policy Commons databases through color coding. For the creation of the data extraction tool, categories were defined for the information, including: i) the theme of the documents; ii) year of publication; iii) document type; iv) abstract; v) identification of which phase of the PPCDAm the document refers to, which may vary in terms of the institutionalization of the plan, the phase analyzed, and its dismantling.

RESULTS

The results of each step in the process of selecting and including the documents to be analyzed in this review are represented, in accordance with the JBI recommendations for ScR, through the PRISMA flowchart, presented in Figure 1 below.

Figure 1- PRISMA Flowchart: Results of the Document Selection and Inclusion Stages for the Review on the Institutionalization and Dismantling of the PPCDAm



Source: The authors (2024).

The search in the Scopus database, conducted on November 1, 2023, resulted in the retrieval of a total of seven documents, distributed irregularly over eleven years, between 2013 and 2023. Although modest, this coverage in the international literature aligns with the scope of the present investigation.

The search in the BDTD database, conducted on September 5, 2023, yielded results corresponding to a total of nineteen documents, including theses and dissertations, with one duplicate result (which was excluded from the refined database). These documents were distributed irregularly over ten years, from 2013

to 2022. The included theses and dissertations cover the institutionalization of the PPCDAm as well as the first three phases, without addressing or analyzing the dismantling phase.

Regarding the Policy Commons database, the results correspond to the retrieval of a total of 289 documents, of which 62 were written in Portuguese, a criterion for inclusion, and 19 documents were duplicates. At the end of the screening stage, 10 policy documents were included in the refined database, as they met the eligibility criteria. The policy documents cover the institutionalization and the first three phases of the plan, without addressing the fourth phase or making references or analyses regarding the dismantling of the Plan.

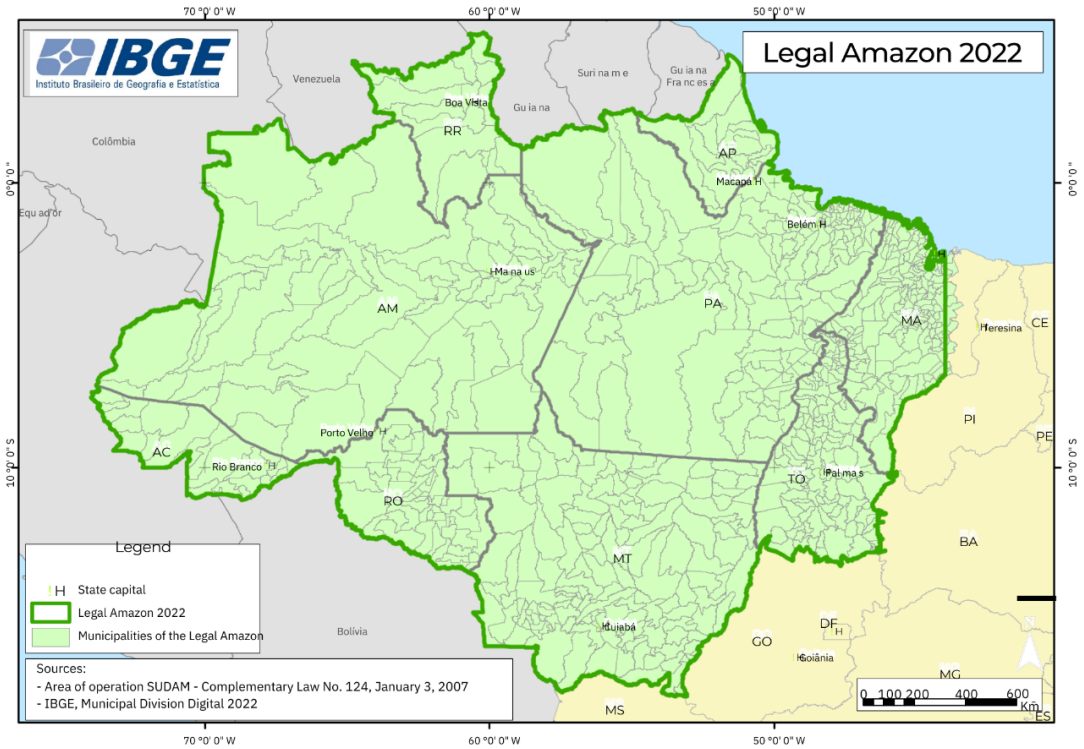
Thus, it was possible, in accordance with the purposes of the ScR methodology following the JBI and PRISMA recommendations, to conduct the mapping of the literature focused on the PPCDAm, taking into account the specificities in terms of keywords, mobilized databases, and other methodological choices. The results provide contributions from this literature on the institutionalization and the first three phases of the Plan, with the gap identified being the analysis of the fourth phase of the PPCDAm, as well as coverage of its dismantling.

Analysis and Discussion

The so-called Grupo Permanente de Trabalho Interministerial (Permanent Interministerial Working Group, whose purposes are presented hereafter) was established on July 3, 2003, through a Presidential Decree with the purpose of implementing and coordinating measures to reduce illegal deforestation rates in the Legal Amazon region. The reader may refer to the text of the non-numbered Presidential Decree (DNN) issued in 2003, as well as the one that revoked it (Brasil, 2003; Brasil, 2019). The 2003 Decree and the creation of this working group reflect a significant decision-making moment at the start of President Lula's first term, aimed at addressing the deforestation issue in the Amazon, which was a focal point of attention under the leadership of Marina Silva, then Minister of the Environment (Kageyama; Dos Santos, 2011; Capobianco, 2022).

The Legal Amazon was demarcated by government agencies to geographically define the region for economic and social planning purposes (Agência Brasil, 2021). The region consists of 9 Brazilian states: Acre, Amapá, Amazonas, Pará, Rondônia, Roraima, Mato Grosso, Tocantins, and part of Maranhão, as shown in Figure 2.

Figure 2 - Legal Amazon 2022



Source: IBGE (2022a).

Based on a thorough evaluation of the causes of deforestation, the PPCDAm was established as the Plan for the Prevention and Control of Deforestation in the Legal Amazon,

coordinating relevant bodies concerning federal government public policies, as it involved cooperation among various ministries, namely: Agriculture, Livestock and Supply (MAPA), Science and Technology (MCT), Defense (MD), Agrarian Development (MDA), Development, Industry and Foreign Trade (MDIC), National Integration (MI), Justice (MJ), Environment (MMA), Mines and Energy (MEE), Labor and Employment (MTE), Transport (MT), Planning, Budget and Management (MPOG), and Foreign Relations (MRE). The coordination was under the responsibility of the Civil House of the Presidency of the Republic until March 12, 2013, when it was transferred to the MMA. This approach to tackling deforestation, which involved a multi-actor articulation, stemmed from the diagnosis that combating deforestation could not be carried out in isolation by the Ministry of Environment (Silva, 2017; Mello; Artaxo, 2017).

First Phase of the PPCDAm (2004-2008)

The first phase of the PPCDAm was announced on March 15, 2004, based on a diagnosis of the deforestation characteristics of that period. In this context, the Plan's first phase aimed to combat deforestation through a strategy built on a critical set of guidelines, which can be summarized as follows: valuing the forest for biodiversity conservation, managing timber and non-timber forest products, and providing environmental services; implementing incentives for the sustainable use of already deforested areas; developing land and territorial zoning measures; improving monitoring, licensing, and deforestation enforcement instruments; promoting cooperation among government institutions responsible for policies related to deforestation dynamics in the Legal Amazon; and encouraging effective participation of Amazonian society sectors in managing deforestation combat policies (Silva, 2017).

Moreover, the Operational Plan of the PPCDAm was designed based on four thematic axes, described as follows: 1) Land and Territorial Zoning, with emphasis on land policies, the creation and expansion of protected areas, and the demarcation and homologation of indigenous lands; 2) Monitoring and Control, particularly concerning near-real-time satellite monitoring of deforestation, as well as intensifying investigations into environmental crimes and the enforcement of fines; 3) Promotion of Sustainable Activities, supported by rural credit policies, workforce training, and research and development of technologies focused on conservation and sustainable use of resources; 4) Infrastructure, with a focus on the strategic planning of infrastructure works in the transportation and energy sectors, integrating prevention, mitigation, and compensatory measures to be implemented before such works. It is important to note that, regarding this structure of axes, the infrastructure axis was transferred, at the end of this first phase, to the Plano Amazônia Sustentável (PAS - Sustainable Amazon Plan in English (Mello; Artaxo, 2017; Silva, 2017; West; Fearnside, 2021).

The primary focus of the activities promoted during the first phase of the PPCDAm was the "Deforestation Arc" region and the area along BR-156, which connects Santarém, in the state of Pará, to Cuiabá, in the state of Mato Grosso. Additionally, the first phase of the PPCDAm had a total budget of 394 million reais, with 62% allocated to territorial planning activities, 21% to monitoring and control actions, and 17% to promoting sustainable activities (West; Fearnside, 2021).

The following chart 2 summarizes the key legal and institutional instruments —such as decrees, laws, and programs—that constituted the institutional framework for the first phase of the PPCDAm.

Chart 2 - Institutional Milestones of the First Phase of the PPCDAm

Main events (decrees, laws e programs) of the PPCDAm I	
Programa Áreas Protegidas (ARPA, in Portuguese) Protected Ares Program (Decree 4.326 of 2002)	Creation of 50 million hectares of protected areas located mainly near deforestation frontiers. Homologation of 10 million hectares of indigenous territories.
Lei de Gestão de Florestas Públicas (Public Forest Management Law) (Law 11.824)	The law gives transparency to the identification of public forests and speeds up the forest concession process.
Creation of the Distrito Sustentável da BR – 163 (2006) (BR-163 Sustainable District)	Creation of the BR-163 Sustainable District (2006) It covers more than 190,000 square kilometers, with a view to prioritizing public policies that encourage integrated development with forest-based activities.
Sistema de Cadastro Ambiental Rural (CAR - Rural Environmental Registration System, in English) (State Decree 1.148 of 2008)	Database to register deforested areas (legal and illegal) on rural properties and determine forest restoration requirements.
Detecção do Desmatamento em Tempo Real (DETER - the Real-Time Deforestation Detection System, in English)-	Almost real-time detection of deforestation using satellite images.
Sistema de Monitoramento e Detecção das Áreas Degradadas (DEGRAD – Monitoring and Detecting System for Degraded Areas, in English)	System for monitoring and detecting forest degradation (where the forest cover has not been completely removed).
Lista negra de municípios - 2008 (Blacklist of municipalities - 2008)	In 2008, the government announced a list of 36 municipalities (others were later included) in the Legal Amazon that had the highest deforestation rates. They were subjected to intense environmental surveillance, restrictions on the issuing of deforestation licenses, embargoes on illegally deforested areas and restrictions on credit and the market.
Lei de Crimes Ambientais – Lei 9.605 de 1988 (Environmental Crimes Law - Law 9.605 of 1988) (Decree 6.514 of 2008)	Amendment to the Environmental Crimes Law which established new legal grounds for environmental infractions and administrative sanctions.
Resolução da Central do Brasil (Resolution of the Central Bank of Brazil) (Resolution 3.545 of 2008)	Restriction on access to credit from public banks for rural landowners who were not in compliance with environmental and land regulation.
Moratória da Soja - 2006 (Soy Moratorium - 2006)	Associação Brasileira das Indústrias de Óleos Vegetais (ABIOVE - Brazilian Association of Vegetable Oil Industries, in English) and Associação Nacional dos Exportadores de Cereais (ANEC - National Association of Cereal Exporters, in English) undertook not to sell soy from deforested areas (after October 2006).
Pacto de Madeira Legal e Desenvolvimento Sustentável – 2008 (Legal Timber and Sustainable Development Pact - 2008)	Associação das Indústrias Exportadoras de Madeira Legal do Estado do Pará (AIMEX - Association of Legal Timber Exporting Industries of the State of Pará, in English), Grupo de Produtores Florestais Certificados da Amazônia (PFCA - Group of Certified Forest Producers of the Amazon, in English) and government bodies committed to buying timber products only from legal and sustainable sources.
Fundo Amazônia (Amazon Fund) (Decree 6.527 of 2008)	Launched to collect donations for investments in conservation, monitoring and prevention of deforestation, reforestation and sustainable use of forest resources.

Source: The authors (2024) based on West and Fearnside (2021), with contributions from Matos (2016) and MMA (2012).

At the end of the first four years of the PPCDAm implementation, an evaluation was conducted to assess positive experiences and challenges encountered, with the aim of supporting the planning of subsequent phases of the Plan. This evaluation was commissioned by the Ministry of the Environment (MMA, in Portuguese) in 2007, through a technical cooperation agreement with the German Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ). An independent consultancy team, led by agronomist Guilherme Cardoso Abdala, carried out the assessment (Abdala, 2008; Silva, 2017).

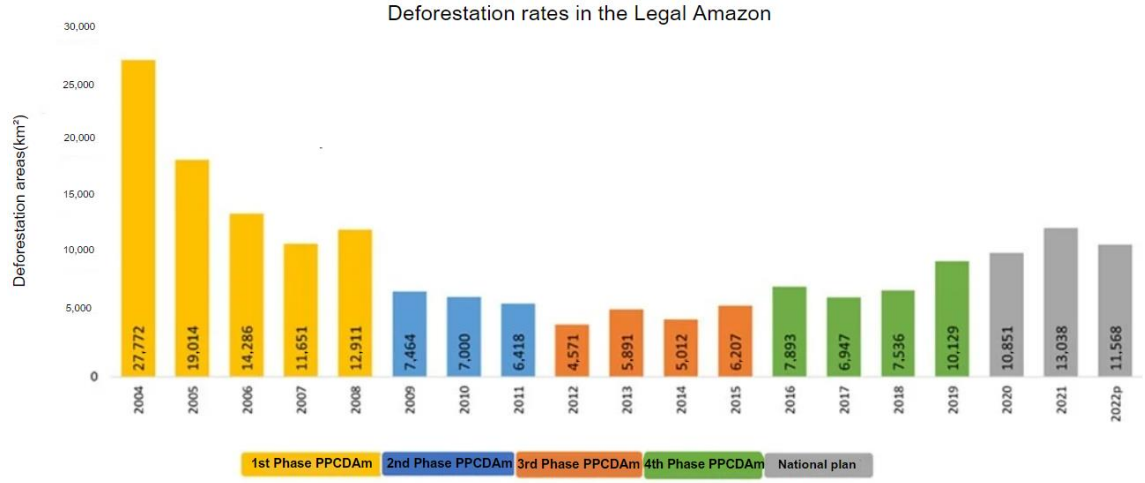
The evaluation revealed varying levels of performance across the thematic subgroups. The "Monitoring and Control" subgroup demonstrated the highest performance, followed by the "Land Tenure Regularization" subgroup, which was rated as having moderate performance. The "Promotion of Sustainable Activities" subgroup was assessed as the least effective, primarily due to planning deficiencies, insufficient funding, and limited access to credit (Abdala, 2008; Silva, 2017; West; Fearnside, 2021).

During the first phase of the PPCDAm, key drivers of deforestation were addressed, including the agricultural sector, which often justified its activities with arguments about the need to expand agricultural frontiers to boost productivity (Abdala, 2008).

However, during this period, a shift in deforestation dynamics was observed, with a significant decrease in the contribution of large deforestation polygons and a relative increase in smaller polygons. Notably, there was also a rise in deforestation rates in 2008, as shown in Figure 3 below. This marked the first year since the plan's implementation in 2004 that deforestation rates increased.

As will be discussed in the following section, these results had important implications for planning the second phase of the PPCDAm.

Figure 3 - Deforestation Rates in the Legal Amazon (2004–2022)



Source: MMA (2022).

Second Phase of the PPCDAm (2009–2011)

The diagnosis of shifts in deforestation dynamics and the observed increase in deforestation in the Amazon, as mentioned above, brought significant implications for reshaping the guidelines incorporated into the Plan for its next implementation period. This marked the second phase of the PPCDAm, spanning from 2009 to 2011, during which the strategic actions were restructured under each thematic axis.

Regarding the Land and Territorial Planning axis, key proposals included land regularization for 296,000 rural holdings and the creation of 20 new Federal Conservation Units, amounting to 6 million hectares, along with the demarcation and official recognition of 4 million hectares of Indigenous Lands (PPCDAm, 2009).

For the Monitoring and Control axis, the second phase prioritized measures to enhance environmental monitoring systems, establish mobile bases to aid in combatting deforestation, create the Companhia de Operações Ambientais da Força Nacional (COA/FN - Environmental Operations Company of the National Force,in English), establish the Comissão Interministerial de Combate aos Crimes e Infrações Ambientais (CICCIA - Interministerial Commission to Combat Environmental Crimes and Infractions, in English), and intensify integrated environmental inspection and accountability operations (PPCDAm, 2009).

With regard to the axis of Promoting Sustainable Productive Activities, the plan's adjustments included proposals to improve public forest management, develop actions for sustainable agricultural and rural development policies, enhance financing and credit mechanisms aimed at environmental conservation, and support extractivist communities as well as projects featuring sustainable production models tailored for the Amazon (PPCDAm, 2009).

Additionally, to improve efficiency, the PPCDAm II reduced the number of promoted activities and adopted a new administrative structure based on priority levels and project deadlines. As highlighted by West and Fearnside (2021), there was consensus among government agencies and experts that land regularization - part of the first axis - was a key factor for virtually all Plan activities. The absence of clearly defined land ownership was identified as one of the unresolved bottlenecks in the region, making it a priority.

However, the budget for the PPCDAm II, which amounted to R$ 1.2 billion, was primarily allocated to the Monitoring and Control and Sustainable Development axes, each receiving approximately 37%, while less than 27% was allocated to the Land and Territorial Planning axis (West; Fearnside, 2021).

The main legal and institutional instruments mobilized for implementing the second phase of the PPCDAm are summarized in Chart 3, which provides an overview of the primary decrees, laws, and programs associated with PPCDAm II.

Chart 3 - Institutional Milestones of the Second Phase of the PPCDAm

Main events (decrees, laws e programs) of the PPCDAm II	
Programa Terra Legal (Terra Legal Program) (Law 11.952 of 2009)	Aims to georeference and regularize land ownership in the Legal Amazon.
Macrozoneamento Ecológico-Econômico da Amazônia Legal (Macro ZEE - (Ecological-Economic Macro-Zoning of the Legal Amazon, in English) (Decree 7.378 of 2010)	Identification of areas suitable for conservation, agricultural and timber Production.
Programa Indicar (Indicar Program) (2009-2012)	Assistance in command and control actions between 2009 and 2012, through technical cooperation between JAXA - Japan Aerospace Exploration Agency and JICA – Japan International Cooperation Agency.
Fundo Nacional para Mudanças Climáticas (National Fund for Climate Change) (Law 12.114 of 2009 and Decree 7.343 of 2010)	Aims to support projects and studies in the field of climate change mitigation and adaptation.
Programa de Manejo Florestal Comunitário e Familiar de 2009 (Community and Family Forest Management Program 2009)	Aimed at improving local livelihoods and combating illegal logging.
Operação Arco Verde (Green Arch Operation) (Decree 7.008 of 2009)	Aimed at promoting sustainable production models, especially in the blacklisted municipalities, as well as fostering the recovery of degraded land.

Source: The authors (2024) based on West and Fearnside (2021).

In 2010, the Ministry of the Environment (MMA, in Portuguese) and the Executive Committee of the PPCDAm commissioned an evaluation of the second phase of the plan, aiming to analyze the results from 2007 to 2010. The evaluation was conducted by the Instituto de Pesquisa Econômica Aplicada (IPEA - Institute of Applied Economic Research, in English), the Comissão Econômica para a América Latina e o Caribe (CEPAL - Economic Commission for Latin America and the Caribbean, in English), with support from the German Agency for International Cooperation

through Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

Similar to the previous phase, the Monitoring and Control thematic axis continued to stand out as the most effective, with much of its success attributed to DETER and the swift response of integrated enforcement actions by Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA - Brazilian Institute of Environment and Renewable Natural Resources is a federal agency under the Ministry of Environment), the Federal Police, the Federal Highway Police, the National Public Security Force, and support from the Brazilian Army.

As for the Land and Territorial Planning and Promotion of Sustainable Productive Activities axes, their activities were classified as having a low degree of action and effectiveness. Despite the expansion of protected areas by 6 million hectares, this expansion was criticized for its slower implementation pace and smaller spatial scale when compared to these same indicators during the first phase (West; Fearnside, 2021).

The evaluation provided general recommendations for maintaining the PPCDAm at a high level of governance, creating actions aimed at reducing bureaucratic obstacles for land regularization, and promoting sustainable activities, as well as maintaining the focus of the Plan's actions in municipalities with the highest deforestation rates (Mello; Artaxo, 2017).

Based on these recommendations, a process of revising the Plan began, culminating in the formulation of the third phase of the PPCDAm.

Third Phase of the PPCDAm (2012-2015)

As previously mentioned, the first two phases of the PPCDAm, which spanned from 2004 to 2008 and from 2009 to 2011, had as their most significant outcome their effectiveness; in other words, the great highlight of the Plan was, in fact, the reduction in deforestation. Actions related to the Monitoring and Control axis, largely associated with the success of the DETER system, were considered a major success. However, the change in the dynamics and pattern of deforestation, primarily characterized by the reduction of deforestation in polygons larger than 25 hectares while smaller polygons (less than 25 hectares) experienced a gradual increase, presented a new challenge for the Plan. The fight against deforestation in small polygons became, effectively, one of the greatest challenges of this third phase, since a large portion of the deforestation occurred below the detection limit of DETER, which is 25 hectares. Accordingly, the third phase of the PPCDAm began by addressing the difficulty of implementing actions that aligned with the new deforestation dynamics, alongside the challenge of revitalizing an axis that had received lukewarm evaluations, namely, the axis of Sustainable Productive Activities, which could potentially lead to structural changes for reducing the pressures driving deforestation (Mello; Artaxo, 2017).

Thus, the actions proposed for the third phase of the PPCDAm were planned based on a new "logical model" or problem tree. This model, the presentation of which falls outside the scope of the present article—due to the mapping focus here—represents a meaningful way of presenting the collective and inter-institutional learning accumulated throughout the first phases of the PPCDAm (MMA, 2013). The mention of the model in the body of the text and its graphical representation succinctly shows how planning for deforestation control progresses within the scope of the Plan's actions. However, it constitutes a detailed and transparent way that allows a good understanding of these advances, which opens up possibilities for further investigation on the topic (MMA, 2013, pp. 169-171).

The logical model was mobilized to address the multiplicity of causes of deforestation in the Amazon, also including institutional and operational aspects of the Plan. Among the causes of deforestation, the review for the third phase of the Plan highlights:

> Illegal occupation of public lands; unregulated expansion of settlements in forest areas; difficulty in tracking the wood supply chain; low viability of production chains that constitute alternatives to deforestation; low production of sustainable timber (PPCDAm, 2016, p.2).

The strategic objectives for the third phase of the PPCDAm were redefined according to each thematic axis. For the Land and Territorial Planning axis, the focus remained on advancing the land tenure regularization of public lands, particularly aiming to "manage the land tenure system in accordance with the various land categories" (Brasil, 2013, p. 70). For the Monitoring and Control axis, the need for greater agility in licensing Forest Management Plans and Forest Concessions was highlighted, with the goal of increasing effectiveness in monitoring and controlling deforestation,

aiming to "promote environmental accountability in the main production chains related to illegal deforestation" (Brasil, 2013, p. 71). Regarding the axis of Promoting Sustainable Productive Activities, actions to promote good agricultural practices and sustainable activities in land reform settlements and Family Farming were emphasized, along with support for increasing timber production through Sustainable Forest Management and actions to develop Science, Technology, and Innovation aimed at sustainable development in the Amazon (Brasil, 2013).

For the third phase of the PPCDAm, the axis considered most important was that of Promoting Sustainable Activities, so that, to strengthen it, priority types of activities were defined, including: promoting sustainable production; supporting Technical Assistance and Rural and Forestry Extension, and the diffusion of Technology and Innovation (ATER, in Portuguese); supporting Local Productive Arrangements and complementary activities (Brasil, 2013).

A series of legal and institutional measures were taken to enable the implementation of the actions in the third phase of the PPCDAm, which are summarized in the following Chart 4.

Chart 4 -Institutional Milestones of the Third Phase of thePPCDAm

Main events (decrees, laws e programs) of the PPCDAm III	
Secretaria Permanente de Gestão Integrada de Proteção ao Meio Ambiente (Permanent Secretariat for Integrated Environmental Protection Management) (Decree 7.957 of 2013)	Aims to strengthen the army's participation in environmental operations.
Cota de Reserva Ambiental (CRA - Environmental Reserve Quota, in English)	A financial mechanism to compensate private properties that exceed minimum forest cover requirements, allowing these surpluses to be marketed as a way of offsetting environmental debts.
Programa de Assentamentos Verdes (Green Settlements Program) (2012)	Developed by Instituto Nacional de Colonização e Reforma Agrária (INCRA – National Institute for Colonization and Agrariam Reform is a federal government authority of the public administration of Brazil) to promote sustainable activities, restoration of degraded land, land regularization and food security.
Redução de Emissões por Desmatamento e Degradação Florestal (REED+ -Reducing Emissions from Deforestation and Forest Degradation in English)	Opportunity to finance conservation and sustainable development initiatives through bilateral agreements between Brazil and developed countries, based on reductions in Greenhouse Gases (GHG) emissions.

Source: The authors (2024) based on West and Fearnside (2021).

The third phase of the PPCDAm had a larger budget compared to the first two phases, totaling 1.4 billion reais, of which 55% was allocated to promoting sustainable activities (i.e., actions related to thematic axis 3), 30% was directed to monitoring and control (axis 2), and 15% to territorial planning (axis 1) (West;Fearnside, 2021).

It is important to note that within the territorial planning thematic axis, the most significant action of the third phase was the controversial revision of the Brazilian Forest Code in 2012, which granted amnesty for illegal deforestation prior to 2008. The direct consequence of this amnesty was the reduction of the total area to be restored, decreasing from 50 to 21 million hectares. According to the new Forest Code, a total of 88 million hectares of private properties could legally be deforested. Additionally, throughout this new phase of the PPCDAm, the expansion of protected areas stagnated (West; Fearnside, 2021).

Fourth Phase of the PPCDAm (2016-2019)

The fourth phase of the PPCDAm is based on the same logical model formulated in 2012, considering that the causes of deforestation were deemed to be virtually the same by the institutions and experts involved. As part of the

formulation process for this new phase, Sectoral Revision Workshops were held, "with the participation of private sector institutions, civil society, states, and the federal government" (PPCDAm, 2016, p.2). Bilateral meetings and workshops with federal government institutions also served as support for the work of the Executive Committee, under the coordination of the MMA, in developing the phase that began in 2016 (PPCDAm, 2016).

In this fourth phase of the PPCDAm, in addition to the three axes from previous phases, a new axis was proposed, focused specifically on the creation of regulations and economic, fiscal, and tax instruments for the prevention and control of deforestation (West; Fearnside, 2021; PPCDAm, 2016).

Thus, the strategic guidelines of the PPCDAm were reformulated to guide actions within the four thematic axes, based on a set of ten guidelines, outlined in the following chart.

Chart 5 - Strategic Guidelines of the Fourth Phase of the PPCDAm

I	The implementation of decentralized and shared management of public policies through partnerships between the Union, States and Municipalities, including their integration with incentives for the promotion of sustainable production systems.
II	Encouraging the active participation of the different sectors of society interested in the management of policies related to the prevention and control of deforestation, strengthening transparency, social control and political ownership.
III	Support for State Plans for the Prevention and Control of Deforestation.
IV	Encouraging sectoral pacts with the productive sector in order to strengthen governance, traceability and the sustainability of production chains in the Amazon, with a view to conserving the forest and reducing deforestation.
V	Combating land grabbing and disorderly occupation of the forestation.
VI	Strengthening the management of protected areas in the Amazon, including conservation units, indigenous lands and other areas under special regime, such as Legal Reserves and Permanent Protection Areas – within the scope of rural properties.
VII	Strengthening the environmental monitoring and inspection system in the Amazon, with the aim of reducing no only deforestation, but also forest degradation.
VIII	Promoting the Rural Environmental Registry as an instrument for managing the landscape and improving forest management.
IX	Valuing forest products (timber and non-timber) and environmental services, in order to encourage the multiple use of the Amazon and not is suppression for alternative land use, promoting a sustainable forest economy.
X	Encouraging the adoption of sustainable farming practices, in order to reduce the demand for new areas for production.

Source: The authors (2024) based on the PPCDAm (2016, p.3).

It is also observed that this fourth phase of the plan included a new focus related to mitigating climate change, with an orientation aimed at meeting the targets established by the National Climate Change Plan for 2020, within the scope of Brazil's NDC. This new focus aligns with the commitment made by Brazil during COP 21, when the country signed the Paris Agreement, ratified in 2016, to achieve zero illegal deforestation by 2030 (West; Fearnside, 2021).

It is possible to observe, through the data released by Projeto de Monitoramento do Desmatamento na Amazônia Legal por Satélites (PRODES – The Project for Remote Deforestation Monitoring in The Legal Amazon, in English), the resumption of increased deforestation rates starting in 2015 during the third phase of the PPCDAm. Despite the "good intentions" represented by the planning changes for the fourth phase of the PPCDAm, as mentioned above, it is precisely during the fourth phase that deforestation starts to accelerate, as shown in Figure 3 presented earlier. It is worth noting that in 2018, 7,536 km² were deforested; in 2019, a total of 10,129 km², representing a 34% increase compared to the previous year. In 2020, deforestation reached 10,851 km², and in 2021, it increased to 13,038 km² (INPE, 2022).

The scope review results allow for the synthesis of evidence on institutional milestones and the outcomes of the implementation and dismantling of the Action Plan for the PPCDAm. This synthesis identifies, for each phase of the PPCDAm, information regarding institutional milestones and results, gathered from the specialized literature reviewed in this ScR, on the following aspects: i) implementation actions of the plan; ii) effectiveness; iii) evaluation; and

iv) other political-institutional aspects. Chart 6 below summarizes this information for the four phases of the PPCDAm, from 2004 to 2019.

Chart 6 - The Four Phases of the PPCDAm: Institutional Milestones and Results (2004-2019)

First phase (2004-2008)	Independent assessment of PPCDAm I, conducted by GTZ and organized by agronomist Guilherme Cardoso Abdala.
	Creation of 50 million hectares of protected area and ratification of 10 million hectares of indigenous territories.
	Implementation of the DETER monitoring system.
	Reduction of around 50% in deforestation rates in 2008 compared to 2004.
Second phase (2009-2011)	Assessment of the PPCDAm II conducted by IPEA, CEPAL and GIZ.
	Change in the dynamics of deforestation, with a reduction in the size of deforested areas to below the DETER detection limit.
	Creation of 6 million hectares of protected area.
	The reduction in deforestation rates continues.
Third phase (2012-2015)	The assessment of PPCDAm III was carried out by federal government institutions, under the coordination of the MMA.
	Revision of the Brazilian Forest Code.
	Stagnation in the creation of protected areas.
	Oscillation in deforestation rates.
Fourthy phase (2016-2019)	Focus on mitigating climate change in order to meet the objectives of the National Climate Change Plan for 2020.
	Brazil signed the Paris Agreement and committed to zero illegal deforestation by 2030.
	Bolsonaro's rise to the presidency and the unleashing of measures to dismantle environmental agencies and deforestation prevention and control programs.
	Deforestation resumes.

Source: The authors (2024).

The results of this ScR indicate that, while the bibliographic and documentary production is of high quality and relevance to the mapping proposed here, it remains quite scarce regarding the period following the change in Brazil's federal administration in 2019.

It is noteworthy that the literature gathers evidence that during Jair Bolsonaro's government, measures were triggered that contributed to symbolically and effectively dismantling the country's environmental agencies and undoing the environmental licensing system, as well as the programs for preventing and controlling deforestation (Souza, 2023; West; Fearnside, 2021). It is therefore not surprising that this administration was marked, between 2019 and 2022, by deforestation rates exceeding 10,000 km² in each year of the period (Risso; De Carvalho, 2022).

CONCLUSION

The objective of this scoping review is to provide a mapping of the literature dedicated to investigating the evolution of the implementation of the PPCDAm plan, its effectiveness in reducing deforestation rates in the Legal Amazon, and the period of its dismantling.

The specialized literature gathered in this review contributes to the understanding of the institutionalization of the PPCDAm as the composition of a very complex and integrated governance framework, articulating federal entities of public administration, with a convergence of scientific knowledge and the use of near-real-time satellite monitoring technology. It also encompassed integrated actions between monitoring and enforcement through IBAMA, as well as coordination with the Federal Police, Federal Highway Police, the National Force, and the Army. The governance framework included the participation of organized civil society and the contribution of technical-scientific knowledge.

Regarding the effectiveness of the Plan's results, the reviewed literature indicates a significant reduction of approximately 80% in deforestation rates in 2012 compared to 2004.

The effectiveness and governance of the Plan are presented as interconnected in the analyses within the mapped literature, as the success of the Plan strongly results from the success of Monitoring and Control of deforestation, the

most successful axis of the plan. Also contributing to this effectiveness during the period from 2004 to 2012, according to the literature, were advances in the demarcation of protected areas.

As evidenced in this mapping, the initial phases included a focus on evaluation actions, which enabled the updating and adaptation of the subsequent phase.

Although limited, the available literature on the fourth phase of the PPCDAm points to a renewal of the guiding principles of the Plan, highlighting the alignment with Brazil's contributions toward meeting the country's targets under the Paris Agreement. Alongside this, the literature identifies the inclusion of a new axis within the structure of the PPCDAm, revealing the growing importance of financial instruments, including fiscal and other economic tools, to stimulate the achievement of deforestation control and reduction targets and promote sustainable development in the Amazon. Despite these advances in the design of the Plan, the literature remains scarce when it comes to evaluations for this period.

In this sense, this review of the specialized literature and policy documents has allowed the identification of a gap in the studies mapped, particularly regarding the analysis of the fourth phase (2016-2019), which corresponds to the period that Souza (2023) identifies as the dismantling of the plan, with more discreet actions during the Temer administration and the active dismantling, including the extinction of the PPCDAm in 2019, under the Bolsonaro government.

This study has limitations that can be categorized into three key aspects. The first limitation pertains to the design of the search strategy, specifically: a) the selection of author keywords, and b) the scope of the covered databases. In this regard, future research could benefit from expanding the keyword set and covering additional databases to broaden the search. The second limitation is related to the contemporary and evolving nature of this field of knowledge. As the PPCDAm has entered its fifth phase, it presents an opportunity for an evaluative study of the achievements and shortcomings of the previous phases, particularly the fourth phase, which remains relatively underexplored due to its recent nature. The third limitation concerns the inherent nature of this investigation. No interviews were conducted with key stakeholders such as the plan's managers, civil society representatives, or other institutions involved in the plan's complex governance structure. We acknowledge that these interviews could provide valuable insights for further deepening the issues addressed in this study, as well as exploring additional aspects beyond its scope. In this context, one potential avenue for future research could be a detailed study of the logical framework guiding the PPCDAm from 2013 onward, including any evaluations and modifications made during the planning of its fifth phase.

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Guilherme Dourado dos Reis: conceptualization, formal analysis, data curation, visualisation, investigation, writing – original draft.

Rosana Icassatti Corazza: conceptualization, methodology, validation, writing – review & editing, supervision, project administration.